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INSTRUCTION BOOK

MODEL 91B RF VOLTMETER

Do Not Issue

Boonton *ELECTRONICS* Corp.

MORRIS PLAINS, NEW JERSEY



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738 SPEEDWELL AVENUE, MORRIS PLAINS, NEW JERSEY, U. S. A.

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RF VOLTMETER

MODEL 91B

SPECIFICATIONS

Range Range

1 Millivolt to 3 volts

Frequency Range

50 Kilocycles to 500 megacycles

Accuracy

Range-Full Scale

.01 to 3 volts

.003 volt

ACCURACY

5% Full Scale to 200 mc
10% Full Scale to above 200 mc

10% Full Scale to 500 mc

Input Impedance

52 Ohm Probe

VSWR 1.10 Max.

High Impedance Probe

Approx. Cap= 2.5 muf above 1 volt
Shunt resistance (see curve)

Power Supply

105 to 125 volts; 55-65 c.p.s. 30 watts

Weight

One 12AX7; one 12AT7; one 6A2; one 6X4

Dimensions

7" wide, 11" high, 9" deep

Maximum probe extension 33 inches from instrument

Height

13 lbs.



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The shunt resistance component is also a variable factor depending upon coil voltage and frequency. An approximation of the shunt resistance component may be obtained from curves in Figure 1 for various combinations of frequency and voltage. Losses in magnetically sealed permeable slugs are also to be considered.

OPERATIVE PROCEDURE

1. Connect power cord to suitable AC power source of from 115 to 125 volts and frequency between 50 and 60 cycles per second whilst in operation. Allow a few minutes warm-up period. A 30 minute warm-up period is usually required to insure meeting specified accuracy.

2. Select either the "Hi-Z" or "52 ohm" probe as desired and connect to instrument by means of special two conductor flexible shielded cable supplied. Check serial number of probe and see that it is the same as that of the voltmeter.

3. Meter movement should be set on zero calibration mark with power switch turned off.

4. Normal meter deflections with zero input signal on probe (Hi-Z probe shorted at input) are as follows:

AGE

DEFLECTION

1/8 to 1/4 inch

.1, .3

Zero

Zero or slightly suppressed

Suppressed

- 3.4. When using low high impedance probe at high frequencies the ground connection must be as short and direct as possible to minimize errors arising from circulating RF currents in the ground return impedance. Connection to the high side must also be as short as possible to minimize resonance side effects at frequencies above 100 megacycles.
- 3.5. When measuring test signal levels greater than .03 volt read appropriate upper scales of meter. If level is below .03 volt read appropriate lower scales of meter.
- 3.6. The 0-35 DB scale is designed to be used in conjunction with the DB setting of the RANGE-FULL SCALE control. To obtain relative level readings in decibels always add the DB meter reading to the DB setting of the RANGE control. When used with a good signal generator the DB scale greatly facilitates the measurement of relative attenuation and bandpass characteristics of filter networks.

PRECAUTIONS

4.1 Overload Effects

RF voltages exceeding 10 volts must not be applied to either probe, or permanent damage to the crystal diodes may result. The 52 ohm probe should not be subjected to continuous overloads exceeding 4 volts.

Maximum DC voltage rating for "HI-Z" probe is 100 volts.
Maximum DC voltage rating for 52 ohm probe is 4 volts.

4.2 Ambient Temperature Effects

The specified full scale voltage accuracy will not be met at excessively high or low ambient temperatures. The normal ambient temperature range for specified accuracy is 65° to 90° F. Do not rest the 91B Voltmeter on top of heat radiating equipment or excessive temperature may affect accuracy. Temperature drift effects will also be noticed after soldering to the tip of the high impedance probe. Avoid making permanent probe connections to sources of heat such as socket terminals on high powered vacuum tubes.

4.3 60 Cycle Pick-Up

When measuring low level RF voltages, precautions should be taken to avoid the possibility of erroneous readings resulting from superimposed 60 or 120 cycle pick-up voltages. Always check for this condition by reducing the RF test signal to zero and noting residual meter deflection from hum pick-up.

5. MAINTENANCE

5.1 Periodic Checking

The Model 31A is designed to give long periods of service without maintenance when serviced in accordance with these instructions. It is recommended, however, that the instrument be checked occasionally against reliable standards to insure against errors resulting from deterioration of diodes or amplifier tubes. To make these checks it is necessary to use a good signal source in the order of 500 Hz with less than 2% distortion at levels up to 3 volts across 50 ohms. A good (averaging response type) electronic oscillator such as the Millitronics Model 310A or 314 or Hewlett-Packard Model 600D or 600B may be used to monitor the signal source for this purpose. The monitoring meter must be checked, however, to insure its accuracy at some low frequency (100 cycles) or good wave form against a dynamometer-type AC meter of at least 1% accuracy.

A set of full scale comparison readings should be taken using both the high impedance probe and the 50 ohm probe. Readings taken with the high impedance probe should not differ from those taken with the 50 ohm probe by a factor greater than indicated in the following table:

RANGE FULL SCALEALLOWABLE PROBE DIFFERENCES

3	volts	2%
1	"	2%
.3	"	2%
.1	"	3%
.03	"	4%
.01	"	5%
.003	"	6%

If the probe differences percentages are appreciably greater than prescribed it is likely that the probe or the lower set of readings is defective and should be replaced. If this case it is advisable to return the instrument and probes to the factory for proper re-examination and adjustment. If a new set of readings is needed.

If the probe differences are less than prescribed, their average value for each range should agree within 5% of the monitor meter. Be sure the 91B has been adequately warmed up for approximately one hour before making this test. Line voltage should be approximately 117 volts.

If the average deviation on the one volt range is appreciably greater than 5% it is advisable to replace the 12AX7 tube and re-check. If the accuracy is not restored try replacing the other tubes or selenium rectifier if necessary to obtain required heater voltage on 12AX7 and 6AU6 tubes. Final accuracy adjustment may be made by means

of the number 8 adjusting screw located on the top rear of the instrument.

With the one volt properly adjusted the other ranges should fall within tolerance. Individual adjustments are provided, however, on all other ranges and these may be reset if necessary. Individual range adjustments are located on the side of the amplifier module and are numbered as follows:

<u>RANGE-FULL SCALE</u>	<u>ADJUSTMENT NO.</u>
.003 volt	1
.01	2
.03	3
.1	4
.3	5
3	7

5.2 Effect of Line Voltage on Accuracy

A change of line voltage from 105 volts to 125 volts should produce less than 1% change in meter reading. Changes greater than 1% indicate excessive deterioration of tubes.

5.3 Replacement of Meter Lamps

On instruments having meters illuminated by 2 1/2" lamps the lamps may be replaced after removing the two holding screws on the front of the meter cover. Instruments having Marion meters must be removed from their cabinets to permit replacement of lamps from rear of meter.

5.4 Field Replacement Components

The following table lists the most readily available components, their functions, and special requirements if any.

<u>COMPONENTS</u>	<u>TYPE NO.</u>	<u>SPECIAL REQUIREMENTS</u>
Rectifier tube	6X4	None
Voltage regulator	0A2	None
Amplifier tube	12AX7	Low noise, Non-Microphonic
Amplifier tube	6AU6	None
Amplifier tube	12AT7	None
Selenium rectifier	Federal No.1016	17.5 volts minimum DC output across heater load
Chopper	Stevens Arnold A-11	Specify power line freq.
Pilot lights & meter bulbs	4V	None
Fuse	1A 250V	None

6.

SHIPPING INSTRUCTIONS

6.1 If it becomes necessary to ship the instrument for any reason it is essential to make sure that the chopper is properly secured in its socket. It has been found necessary to tie a piece of string around the hold down clamps at the base of the obopy to prevent the weight of the chopper from unscrewing these clamps and the falling out during shipment. Very often the clamps are not retied when replacing the chopper in the field.

6.2 Wrap the instrument with heavy wrapping paper and then the same with gummed tape. Place in fibre-board container large enough to permit 3 inches of soft packing material between instrument and sides of the box.

C1	Capacitor, metallized paper	.1 mf $\pm$ 20% 200 V Good-All
C2	Capacitor, metallized paper	.1 mf $\pm$ 20% 200 V Good-All
C3	Capacitor, Mylar	.022 mf. $\pm$ 20% 200 V Good-All 620M22302
C4	Capacitor, metallized paper	2.0 mf $\pm$ 10% 200V
C5	Capacitor, electrolytic (20mf./300V)	Part of 40-20-20 mf./300-300-15V C.D.XC0732
C6	Capacitor, Mylar	.1 mf $\pm$ 20% 200V Good-All 620M10402
C7	Capacitor, electrolytic (20mf. 25v)	See C5
C8	Capacitor, electrolytic (40mf. 300v)	See C5
C9	Capacitor, Mylar	See C3
C10	Capacitor, metallized paper	See C1
C11	Capacitor, Mylar	See C3
C12	Capacitor, mica	.001 mf.
C13	Capacitor, metallized paper	1.0 mf. $\pm$ 20% 200v
C14	Capacitor, metallized paper	1.0 mf. $\pm$ 20% 200v
C15	Capacitor, ceramic	.001 mf.
C16	Capacitor, ceramic	.001 mf.
C17	Capacitor, ceramic	.001 mf.
C18	Capacitor, ceramic	.001 mf.
C19	Capacitor, ceramic	.001 mf.
C20	Capacitor, ceramic	.001 mf.
C21	Capacitor, electrolytic	40 mf. 450v for Ser. Not Below 213 20-30 mf. 450v for Ser. Not above 213
C22	Capacitor, electrolytic	1000 mf. 15v
C23	Capacitor, Mylar	See C3

C87	Chopper	Stevens-Arnold A 11
D1	Diode	1N128
D2	Diode, Selected	
D3	Diode, Selected	
D4	Diode, Selected	
D5	Diode, Selected	
D6	Diode, Selected	
D7	Diode	1N128
F1	Fuse	1A
L1	Choke, filter	Stancor C-1717
M1	Meter	Special

(All deposited carbon resistors are $\pm 1\frac{1}{4}\%$ tolerance unless otherwise noted.)

R1	Resistor, deposited carbon	1 meg.
R2	Resistor, deposited carbon	1 meg.
R3	Resistor, deposited carbon	80.6K ohms
R4	Resistor, deposited carbon	80.6K ohms
R5	Resistor, deposited carbon	8.87K ohms
R6	Resistor, deposited carbon	8.87K ohms
R7	Resistor, deposited carbon	1K ohms
R8	Resistor, deposited carbon	1K ohms
R9	Resistor, deposited carbon	191 ohms
R10	Resistor, deposited carbon	191 ohms
R11	Resistor, deposited carbon	97.6 ohms
R12	Resistor, deposited carbon	97.6 ohms

R11	Resistor, composition	4.7K ohms
R11A	Resistor, composition	4.7K ohms
R15	Resistor, composition	2.2 meg.
R16	Resistor, composition	1K ohms
R17	Resistor, deposited carbon	1.3K ohms
R18	Resistor, variable	5K ohms $\pm$ 20%
R19	Resistor, composition	1 meg.
R20	Resistor, composition	2.2 meg.
R21	Resistor, deposited carbon	499K ohms
R22	Resistor, composition	6.8K ohms
R23	Resistor, composition	4.7K ohms
R24	Resistor, composition	470K ohms
R25	Resistor, composition	1 meg.
R26	Resistor, deposited carbon	2.26K ohms
R27	Resistor, deposited carbon	499K ohms
R28	Resistor, composition	1 meg.
R29	Not used.	
R30	Resistor, composition	470K ohms
R31	Resistor, composition	22 ohms
R32	Resistor, composition	1 meg.
R33	Resistor, composition	100 ohms
R34	Resistor, composition	22 ohms
R35	Resistor, deposited carbon	7.5K ohms
R36	Resistor, deposited carbon	3.48K ohms
R37	Resistor, composition	10K ohms
R38	Resistor, composition	10K ohms
R39	Not used.	
R40	Resistor, deposited carbon	52 ohms

R41	Resistor, composition	10K ohms
R42	Resistor, composition	10K ohms
R43	Not used.	
R44	Resistor, composition	7.5K ohms $\pm 10\%$ 10W
R45	Resistor, composition	3.3K ohms
R46	Resistor, composition	470 ohms
R47	Resistor, variable composition	15K ohms $\pm 20\%$
R48	Resistor, variable composition	1K ohms $\pm 20\%$
R49	Resistor, variable composition	1K ohms $\pm 20\%$
R50	Resistor, variable composition	1K ohms $\pm 20\%$
R51	Resistor, variable composition	1K ohms $\pm 20\%$
R52	Resistor, variable composition	250K ohms $\pm 20\%$
R53	Resistor, variable composition	250K ohms $\pm 20\%$
R54	Resistor, composition	330K ohms
R55	Resistor, composition	1K ohms
R56	Resistor, composition	470 ohms
R57	Resistor, composition	470 ohms
R58	Resistor, composition	1K ohms
R59	Resistor, composition	33K ohms $\pm 5\%$ 1W
R60	Resistor, composition	15K ohms
R61	Resistor, composition	5.6K ohms $\pm 5\%$ 2W
SRI	Rectifier, Selenium	FTR 1016
2	Switch, special	
3	Switch, toggle, DPST	
T7	Transformer, power	Stancor P6400 for Ser. Nos. below 213 Stancor P8401 for Ser. Nos. above 213
T8	Transformer, power	Stancor P6400

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